Muhlenbergia cualensis and *M. michisensis* (Poaceae: Eragrostideae): Two New Species from Mexico

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ABSTRACT. *Muhlenbergia cualensis* from Jalisco, and *M. michisensis* from Durango, Mexico, are described and illustrated. A table distinguishing among the new species and related taxa is given.

The genus *Muhlenbergia* Schreber is represented in Mexico by at least 115 species, of which 47 percent are endemic (Beetle, 1987). Morphological characters that delimit the genus are spikelets with a single perfect floret and lemma usually with three prominent nerves. While collecting for a systematic study of *Muhlenbergia montana* (Nutt.) A. Hitchc. and related species in the Sierra Madre of Durango (Herrera, 1991), a morphologically distinct taxon was discovered. Later, during an examination of herbarium specimens, a second new taxon was found. The *Muhlenbergia montana* complex is a loose assemblage of caespitose, nonrhizomatous perennials of perhaps 12 species that usually have a dentate or 3-toothed second glume and an awned lemma. Members of this complex generally occur above 1,000 m in pine and oak forests from Montana to California and Texas, and extend southward into Mexico and Guatemala. These two new species and an accompanying table are presented prior to completion of the overall treatment of the *Muhlenbergia montana* complex, so others in Mexico may become aware of their existence and search for additional locations. The specific epithet of *M. cualensis* is derived from the Sierra el Cuale, the type locality, and the epithet of *M. michisensis* refers to the small village of San Juan de Michis where it was first collected.

Muhlenbergia cualensis Herrera & P. Peterson, sp. nov. TYPE: Mexico. Jalisco: SSE of Puerto Vallarta, 14 km from the opening of the Zimapán Mine, 1 km W of Providencia boundary El Tuito–El Cuale, 20°15′N, 105°15′W, 31 Jan. 1983, *R. Guzmán 6090* (holotype, COCA; isotypes, IBUG, US). Figure 1.

A *Muhlenbergia eriophylla* culmis altis 50–70 cm, ligulis 10–12 mm longis; laminis planis ad involuta supra hirsutula; paniculis 15–25 cm longis; lemmatibus (2.6–)2.8–3.0 mm longis, aristatis luteolis, recedit.

Densely caespitose perennial without rhizomes. Culms 50–70 cm tall, erect, rounded and branching near the base, puberulent just above the mostly basal nodes; internodes mostly glabrous. Sheaths 7–34 cm long, mostly longer than the lower internode, glabrous to scaberulous, stiff and papery below, usually folded; margins membranous. Ligules 10–12 mm long, membranous, hyaline, decurrent; apex acuminate, often lacerate. Blades (11–)20–25 cm long, 0.5–2 mm wide, flat to involute, apically acuminate, somewhat stiff, hirsutulous above and glabrous to scaberulous below. Panicles 15–25 cm long, 0.7–4 cm wide, narrow to somewhat open, loosely flowered, ascending branches mostly loosely appressed or spreading up to 35° from the culm axis; pedicels 0.6–3 mm long, flattened, ascending, scabrous to scaberulous; inflorescence branches 0.6–7 cm long; central axis with 4–6 ribs near base. Spikelets 3–4 mm long, erect, 1-flowered. Glumes (3–)3.5–4 mm long, oblong, longer than the lemma, usually equal in length, 1-nerved, olivaceous, short pilose near base and along nerve; apex acute to obtuse, occasionally minutely erose. Lemma (2.6–)2.8–3.0 mm long, oblong-lanceolate, awned, olivaceous; midnerve, margins, and proximal ⅓ to ¾ loosely to densely appressed pubescent to pilose, the hairs up to 0.4 mm long; apex acute to acuminate; the awn 16–20 mm long, yellow, flexuous to straight. Palea (2.6–)2.8–3.0 mm long, oblong, the proximal ⅔ loosely to densely appressed pubescent to pilose between the nerves; apex obtuse with an abruptly mucronate tip. Anthers 1.6–2.2 mm long, purple. Caryopsis not seen.

Figure 1. *Muhlenbergia cualensis* Herrera & P. Peterson, Jalisco, Mexico (*R. Guzman 6090*). —A. Habit. —B. Ligule. —C. Inflorescence. —D. Spikelet. —E. Glumes. —F. Lower glume, dorsal view. —G. Floret. —H. Lemma, dorsal view. —I. Lemma, ventral view. —J. Palea, dorsal view. —K. Palea enclosing the pistil and lodicules, ventral view. —L. Palea and stamens, lateral view.

Figure 2. *Muhlenbergia michisensis* Herrera & P. Peterson, Durango, Mexico (*Herrera & Acevedo 986*). —A. Habit. —B. Ligule. —C. Inflorescence. —D. Spikelet. —E. Glumes. —F. Lower glume, dorsal view. —G. Floret. —H. Lemma. —I. Palea, dorsal view. —J. Palea enclosing the stamens, pistil, and lodicules.

TABLE 1. Salient characters distinguishing *Muhlenbergia cualensis*, *M. durangensis*, *M. eriophylla*, *M. michisensis*, and *M. watsoniana*.

Characters	*M. cualensis*	*M. durangensis*	*M. eriophylla*	*M. michisensis*	*M. watsoniana*
Rhizomes	absent	present	absent	absent	absent
Ligule length (mm)	10–12	0.5–0.7(–1)	8–10	4–7	0.5–1
Adaxial blade surface	hirsutulous	scabrous	long villous	hirsute-glabrous	hirsutulous
Panicle length (cm)	15–25	10–25	4–13	12–17	4–12(–15)
Spikelet length (mm)	3–4	(5–)6–7(–7.5)	3.5–4	4.5–5	3–3.8
Glume length (mm)	(3–)3.5–4	(5–)6–7(–7.5)	3–4	4.5–5	3–4
Second glume shape	entire to erose	entire	dentate	entire	erose
Lemma length (mm)	(2.6–)2.8–3	5–6.7(–7)	3–3.5	3.5–4	2.5–3.3
Lemma awn	flexuous-straight	flexuous	straight	flexuous	flexuous
Lemma awn color	yellow	yellow	olive-green	purplish yellow	yellow
Anther length (mm)	1.6–2.2	(2.5–)3–3.5	1.8–2	2–2.4	1.7–2

Distribution and habitat. Muhlenbergia cualensis is known only from the area surrounding the Zimapán Mine at approximately 1,000 m in the mountains southeast of Puerto Vallarta. At this location *M. cualensis* occurs on sandy to sandy clay loam slopes with granitic stones in open forests of *Quercus* and *Pinus ayacahuite* Ehrenb.

Additional specimens examined. MEXICO. JALISCO: E of the Zimapán Mine, 31 Jan. 1983, *R. Guzmán 6100, 6101, 6102, 6104* (all COCA).

Muhlenbergia cualensis is morphologically very similar to *M. eriophylla* Swallen, which can be distinguished from the former by possessing culms 17–40 cm tall, ligules generally 8–10 mm long, leaf blades with large, silvery, densely appressed-villous, unicellular macrohairs that measure 0.1–0.2 mm wide and up to 4 mm long, panicles 4–13 cm long, and lemmas 3–3.5 mm long with olive-green awns (see Table 1). The leaf blade in transverse section of *M. cualensis* differs from *M. eriophylla* by having elliptical or vertically elongated primary (I°) vascular bundles that alternate between a single, smaller tertiary (III°) vascular bundle. In *M. eriophylla* the I° vascular bundles are circular or round in outline, and there are two vascular bundles, either secondary (II°), III°, or in combination, between each I° vascular bundle.

Muhlenbergia cualensis resembles *M. watsoniana* A. Hitchc., although the latter differs in a few morphological characteristics. Short ligules (0.5–1 mm long), folded leaf blades, and short, narrow panicles (4–12 cm long × 1–2 cm wide) are the most prominent features of *M. watsoniana*.

The flavonoid chemistry of *M. cualensis* is most similar to *M. flaviseta* Scribner and *M. virescens* (Kunth) Kunth by sharing the following compounds: quercetin 3-O glucoside with *M. virescens;* and luteolin 5-O glucoside, luteolin 6 arabinoside, luteolin 7-O galactoside, apigenin 6, 8 diglucoside (vitexin), apigenin 7-O arabinoside, tricin 5-O glucoside, tricin 7-O glucuronide, and 4′hydroxyflavone 7-O glucoside with both species (Herrera & Bain, 1991).

Muhlenbergia michisensis Herrera & P. Peterson, sp. nov. TYPE: Mexico. Durango: Municipio de Suchil, Las Escobas, San Juan de Michis, 23°24′N, 104°8′W, 17 Sep. 1989, *Herrera & Acevedo 986* (holotype, CIIDIR; isotypes, MTMG, US). Figure 2.

A *Muhlenbergia durangensis* rhizomate nullo; ligulis 4–7 mm longis; spiculis 4.5–5.0 mm longis; glumis 4.5–5.0 mm longis, glumis secundis 1-nervis vel 2-nervis; lemmatibus 3.5–4 mm longis; paleis 2.8–3.5 mm longis, apice 3-lobis; antheris 2–2.4 mm longis, recedit.

Densely caespitose perennial without rhizomes. Culms 68–80 cm tall, branching and rounded near base, glabrous just below the mostly basal nodes; internodes glabrous. Sheaths 8–14 cm long, mostly longer than the lower internode, scaberulous, becoming flattened and conspicuously spirally coiled below, loose and papery. Ligules 4–7 mm long, membranous, hyaline, decurrent; apex acuminate. Blades (8.5–)10–20 cm long, 1–3 mm wide, flat to folded or involute, scabrous below and glabrous to sparsely hirsute above. Panicles 12–17 cm long, 2–4 cm wide, open, loosely flowered, ascending branches mostly spreading 20–50° from the culm axis; pedicels 0.2–1 mm long, short and stout, scabrous to hispid; inflorescence branches 0.4–3 cm long; central axis triquetrous, 3–6-ribbed, scabrous. Spikelets 4.5–5.0 mm long, erect, tightly clustered or paired along each branch, 1-flowered. Glumes 4.5–5.0 mm long, oblanceolate, entire, longer than the lemma, usually equal in length, 1-nerved, oc-

casionally the second 2-nerved, olivaceous, scabrous along the entire length and usually short pilose near base and along midnerve; apex acute. Lemma 3.5–4.0 mm long, oblong-lanceolate, hyaline to yellowish, awned; midnerve and margins on the proximal ¾ appressed pubescent to pilose, the hairs to 0.3 mm long; apex acute, minutely bifid, the lobes to 0.2 mm long, the awn 10–15 mm long, flexuous, yellowish distally and purplish near base. Palea 2.8–3.5 mm long, oblanceolate, loosely appressed pubescent between the nerves on the proximal ⅘; apex 3-lobed to tridentate, the lateral lobes obtuse and the central lobe acute. Anthers 2–2.4 mm long, reddish purple. Caryopsis not seen.

Distribution and habitat. *Muhlenbergia michisensis* is known from southeastern Durango, southwest of Vicente Guerrero between 2,450 and 2,650 m. It occurs on rocky slopes in forests composed of *Quercus* and *Pinus*.

Additional specimens examined. MEXICO. DURANGO: Cerro Blanco, Reserva de la Biosfera "La Michilia," 17 Apr. 1986, *S. González 3740* (CIIDIR); San Juan de Michis (Potrero de Escobas), 23 Jan. 1986, *J. Alvarado, s.n.* (CIIDIR).

Muhlenbergia michisensis is morphologically similar to *M. durangensis* Herrera, which can be distinguished from the former by having short rhizomes; ligules 0.5–0.7(–1) mm long; spikelets (5–)6–7(–7.5) and glumes (5–)6–7(–7.5) mm long, the second 3-nerved; lemmas 5–6.5(–7) cm long with awns (10–)15–20(–25) mm long; paleas 5–6 mm long; and anthers (2.5–)3–3.5 cm long (Table 1).

The flavonoid chemistry of *M. michisensis* is most similar to *M. eriophylla* by sharing: quercitin 3-O rhamnosilxyloside, luteolin 6 galactoside, luteolin 6 glucoside, luteolin 8 glucoside, apigenin 6, 8 diglucoside (vitexin), apigenin 7-O arabinoside, apigenin 7-O diarabinoside, apigenin 7-O glucoside, tricin 5-O glucoside, tricin 7-O glucuronide, and 4′hydroxyflavone 7-O glucoside (Herrera & Bain, 1991).

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Literature Cited

Beetle, A. A. 1987. Noteworthy grasses from Mexico XIII. Phytologia 63: 209–297.

Herrera, Y. A. 1991. A biosystematic study of *Muhlenbergia montana* complex (Poaceae, Eragrostideae). Master's Thesis, McGill University, Montreal.

——— & J. F. Bain. 1991. Flavonoid profiles in the *Muhlenbergia montana* complex (Poaceae). Biochem. Syst. Ecol. 19: 665–672.